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Request for grant of a patent

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1. Your reference — SMC/LF/P3997 — 05 FEB 1998

2. Patent application number *(The Patent Office will fill in this part)* — 9802415.1

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Danmere Limited
Whitehall
75 School Lane
Hartford
Northwich Cheshire CW8 1PF

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

6986240002

4. Title of the invention — Storage Tape Control System

5. Name of your agent *(if you have one)* — ROYSTONS

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Tower Building
Water Street
Liverpool
L3 1BA

Patents ADP number *(if you know it)* — 1438001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

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Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	13
Claim(s)	2
Abstract	-
Drawing(s)	2

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature ROYSTONS - AUTHORISED AGENTS Date 05-02-98

12. Name and daytime telephone number of person to contact in the United Kingdom S M Cardwell - 0151 236 1417/5147

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Notes

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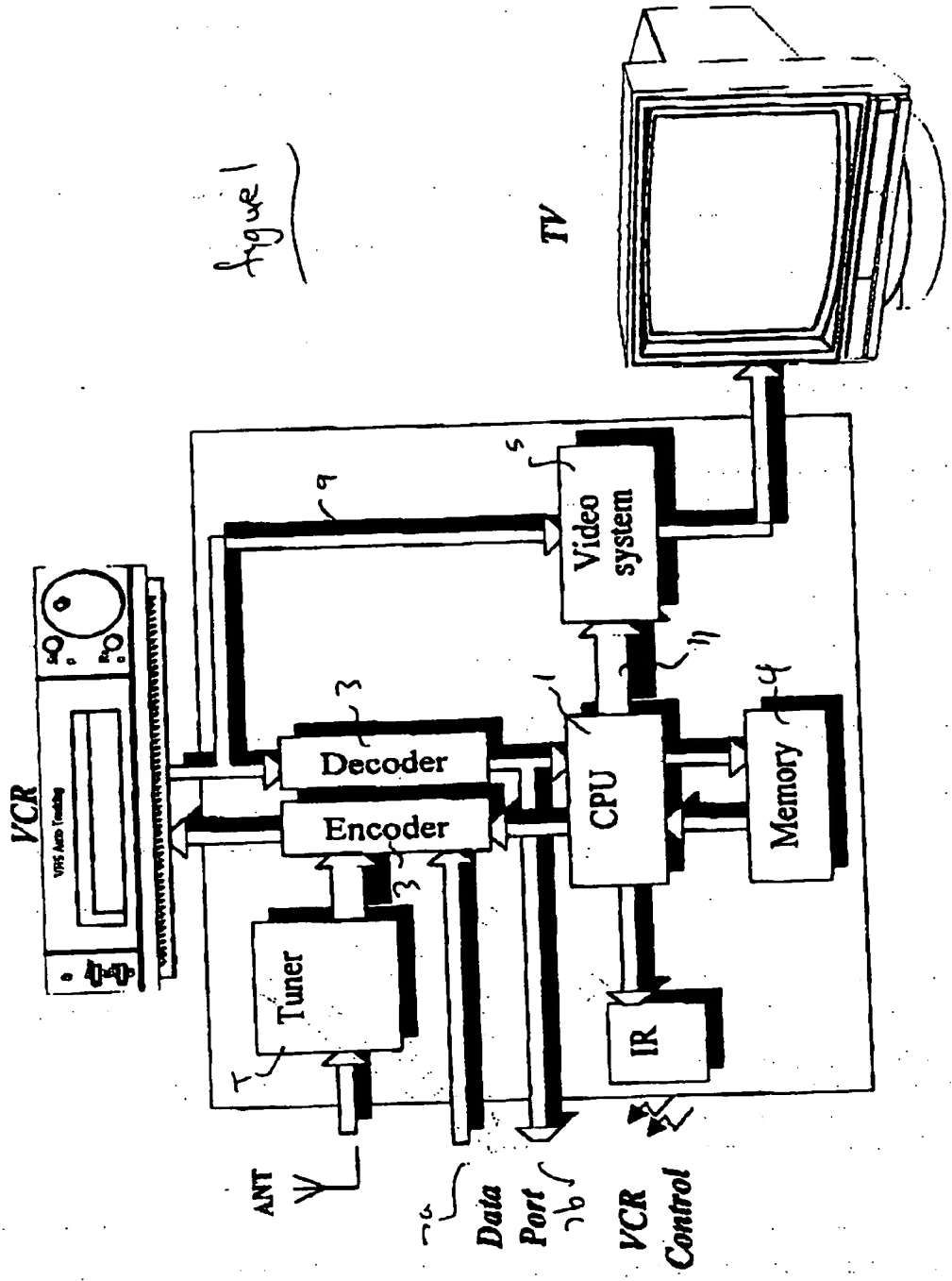
figure 1


TV
Video system
Decoder
Encoder
CPU
Memory
Tuner
IR
VCR
ANT
Data Port
VCR Control

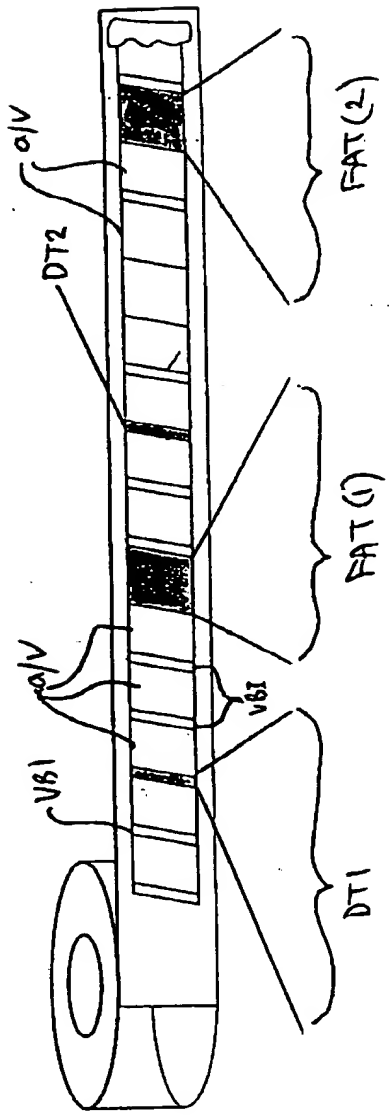


Figure 2

Title: Storage Tape Control System

DESCRIPTION

The present invention relates to a control system to control a tape storage device, and to the storage and retrieval of information recorded on a tape storage device.

Magnetic tape storage devices are widely used for recording audio and video signals. When recording programme material of this type the running time is usually known and it is possible to estimate the amount of recording time on a tape by noting the physical position of the tape. Even so, when multiple sets of programme material are recorded on one tape the ability to locate a specific programme is limited. Some index search facilities enable the commencement of each new recording event to be located, but otherwise location of any particular recording has to be a matter of trial and error, perhaps using the tape counter as a guide to the location of the desired material as it provides only a indirect and approximate measure of tape position.

This contrasts markedly with the indexing provisions which are possible with disks storage mediums. These are able to provide a directory of the disk contents as well as information identifying the exact location of a particular item on the disk, the amount of space taken up by that item and the amount of space available for recording new data.

The likes of a video cassette as used in a video cassette recorder has the capacity to store large quantities of data - be it picture component or data when correctly formatted, but the above mentioned difficulties in connection with the

subsequent location of selected ones of multiple sets of recorded material and the difficulty of ascertaining the amount of recording space remaining on a tape make tape storage systems inconvenient to use. The position is further complicated when data signals are to be recorded as video cassette recorders will not all frames enticing digital be it picture or other necessarily be able to accept the same data rates. I.e. the encoding of the data to suit the bandwidth of the VCR may require different amounts of tape depending on the number of lines and/or frames that the information is spread over.

It will be apparent from the above that the problem with video tape as a storage medium for multiple sets of information is that there is no electronically readable index providing information as to what is on the tape, where it is located and how much of the tape is available for recording. The present invention aims to provide a solution.

Accordingly, one aspect of the present invention provides a tape control system comprising means operable to control a tape storage device, said means including means for determining tape position based on data received from a tape reading means, which data has previously been encoded onto the tape.

Such a system enables individual selection and retrieval of multiple sets of recorded data and signals. Means is provided for encoding the data which may comprise time code or other data which is encoded onto the tape at periodic intervals by a tape recording means. It is preferred that the data is recorded during the recording of the tape. The recorded data may alternatively or additionally record frame number, total frames and session name. For convenience such recorded data is

hereinafter referred to as a data index. The data indexes are recorded at periodic intervals along the tape in such a way to facilitate reading by the playback head of a tape recorder at least during play back. Analysis of the data will determine the position of the tape directly from the tape rather than indirectly from a tape cassette. Typically the data indexes are written every second or fraction thereof.

The present invention has application to any tape storage system but one particular application is to the control of a video tape and for ease of reference the invention will be described further hereinafter in relation to such hence the reference to the like of Video Cassette Recorder (VCR), video tape type and Television screens. It is preferable for the data to be recorded at positions on the tape corresponding to the Vertical Blanking Interval.

The tape control system is controlled using an infra-red control signal. Existing infra-red controls only permit tape control in respect of playback, fast forward, fast rewind, record and basic index searching. By reading tape position data direct from the tape, it is possible to locate specific positions on the tape.

Where the data index is readable only on playback, the fast forward and fast rewind characteristics of the video cassette recorder are advantageously assimilated (hereinafter referred to as characterisation data) by the control means i.e. the tape velocity and acceleration rates are reviewed so that the controller can compute the length of tape which will be processed in a particular time and can operate the fast forward rewind of the tape for the appropriate time to reach the desired tape position. When the recorder switches to playback the next data index which is read will enable the controller to determine whether any further fine positioning adjustments are

required. Once the characterisation data of a video recorder is known the desired position can be arrived at quickly once the current tape position is known. The characterisation data may be derived from a code produced by the VCR manufacturer so avoiding the need for the characterisation data assimilation techniques. Advantageously means is provided for issuing infra-red command sequences to automatically reposition the tape to a selected desired position utilising characterisation data determined for said tape storage device.

Determination of characterisation data for the VCR as concerns for example fast forward and rewind characteristics can be accomplished by operating the VCR in fast forward and rewind modes as the case may be at the beginning and end regions of the tape for prescribed intervals of say 5 seconds, 10 seconds and 20 seconds and using the noted data index values to produce a performance curve from which the time of operation can be correlated with tape position for the whole length of a tape.

The desired position is selected having regard to an index of material recorded on the tape which index provides information identifying the nature of the recorded material and its position on the tape. Such information (file data) is conveniently referred to as a file index or a file allocation table (hereinafter referred to as a FAT) and may be stored externally to the tape as well as on the tape. More particularly each recording session terminates with the recording of a file allocation table. The successive file allocation tables are cumulative. The information identifying the position of a particular item may comprise a note of its start and end positions or one of these and its length, in terms of say frame number, a time or any combination of same. Such information is stored in memory from data read from the

tape and/or input by the user. For example programming software is employed to provide control menus to be read on a T.V. screen and/or a display on the infra-red handset from which VCR control options can be selected including titling of the tracks for indexing purposes and control of the recorder in relation to recording T.V. pictures, data transmitted with the T.V. pictures and pure data, or any combination thereof.

Accordingly another aspect of the invention comprises recording a file index on storage tape which file index relates to the contents of the tape.

The tape contents may comprise one or more sets of signals or data. This aspect of the invention further comprises recording data associated with the position on the tape of the set or sets. More particularly, multiple copies of said file index or file allocation table (hereinafter referred to as a FAT) are stored on said storage tape in different locations. This enables quick recovery of the index data. More particularly still, a new FAT is written to said storage tape when a new signal or data (recorded material) is appended to the tape. It is particularly convenient if each new FAT contains not only data related to the newly recorded material but also data relating to all the previously recorded material on the tape so that the successive FATs are cumulative. Thus each successive index will be of increased size. To facilitate creation of such a FAT, means is provided for reading and memorising the contents of the FAT immediately preceding the newly recorded material. The reading of the information is performed by the VCR playback head. Programming means is conveniently incorporated to control tape movement to facilitate reading into memory of the last FAT if not already present in order to facilitate adding to the subsequent

FAT. Accordingly a separate storage means is provided for holding a copy of the FAT as well as means which is operable to read copies of the FAT stored in said separate storage means.

The data retrieved from a tape and the associated programme control circuitry is used to determine how much unused tape is available for storage of new signals or data. Furthermore the programme control circuitry is used to select which existing signals or data can be over written in order to provide sufficient storage for new signals or data. Conveniently an on screen menu is provided and/or a hand set display.

The present invention will now be described further, by way of example only, with reference to the accompanying drawings; in which :-

Figure 1 illustrates in block diagram form circuity for implementing the present invention, and

Figure 2 is a diagrammatic perspective view of a length of video tape illustrating diagrammatically the indexing provisions applied thereto according to the various aspects of the present invention.

A tape control system according to the present invention comprises a means operable to control a tape storage device via an infra-red control signal and a means for determining tape position based on the data received from a tape reading means. The tape reading means reads time code or other data encoded on to the tape so as to enable individual selection and retrieval of multiple sets of recorded data and signals.

For one particular application which we have in mind the tape storage medium comprises a video tape and the signals to be recorded may comprise audio visual

signals or data signals or a combination of both. In our co-pending application we describe how data signals transmitted by a terrestrial, cable and satellite T.V. networks can be converted into a form suitable for storage on to magnetic storage tape. Such data may be stored alongside analog or digital picture components. We also describe how a video cassette can be used to provide a high capacity data storage system for storing entire digital frames of data on the same tape as the analog video component to facilitate storage and retrieval of associated data down loaded from the Internet or other sources of such information. In such an application it becomes advantageous to be able to retrieve the information quickly and to be able to identify the information recorded on the tape. It is also advantageous to be able to automatically access that information and when it is no longer required to be able to designate previously recorded areas as available for over recording and/or deletion of previously recorded matter.

In order to be able to accurately determine tape position the present invention provides means for applying a marker at intervals along the tape. Ideally the marker provide a time code, frame number and total frame elapsed since the start of the tape and optionally a session name. These markers are recorded on the tape during recording thereof and reading of the markers enables a specific location to be arrived at by appropriate forward and reverse movement on the tape under programme control.

Different video cassette recorders (VCR) will have different operating parameters especially in relation to fast forward and rewind modes. For example some video recorders reach fast forward or fast reverse speeds more quickly than

others. The markers on the tape can be used to determine the operational characteristics of the video recorder in which the tape is located. Thus by operating the cassette recorder in rewind and fast forward modes the time of operation in either of those modes can be correlated with tape distance so that when the controller switches back to playback mode the next occurrence of a marker will enable the program to decide whether the tape is in the intended retrieval position or whether it needs to go forwards or backwards towards the intended position of the data to be retrieved. In a preferred embodiment characterisation data for the VCR is used to ensure that the desired tape position is located as quickly as possible. This characterisation data may be derived from a manufacturers code or assimilated using an assimilation routine such as previously outlined.

Referring more specifically to Figure 1, a video cassette recorder (VCR) and a television (TV) are illustrated and a block diagram of processing circuitry which may be a self contained unit or incorporated into the VCR or another signal processing device where it is desired to avoid unnecessary component duplication. The processing circuitry includes a CPU 1, an encoder 2, a decoder 3, a memory 4 and an infra-red control unit IR. The also illustrated is a tuner T for processing television signals. I/R unit send VCR I/R codes and receives handset commands. Line 9 transmits the signal to be displayed on the television. Video system 5 displays options on the TV screen as mentioned further hereinafter. The CPU generates signals for text or graphics for the TV screen which are sent to the video system over line 11. Line 7a represents an output line for data decoded from a tape.

When the VCR is operating in record mode signals to be recorded, for

example TV signals decoded by the tuner T or other signals input by way of the data port input line 7a, are passed to the encoder 3. Under the control of the CPU data index signals are generated and combined with the other signals at prescribed intervals, for example every second or part thereof. Where the signal to be recorded includes picture component, then the data signals are conveniently timed to reside in the vertical blanking interval between selected frames. The information recorded as part of the data index may comprise any preferred combination of time code, frame number, total frames elapsed and/or session name.

The information available from the data index enables any desired position to be located on the tape as will be described further hereinafter.

Selection of the desired position is made easier if the user knows what is recorded on the tape at any particular position. Accordingly, the invention also proposes storing in a file index or file allocation table (hereinafter referred to as a FAT) information on the tape corresponding to the contents of the tape.

The contents of the tape may comprise one or more sets of signals or data. The FAT is created using associated programming software incorporating a character generation set to facilitate titling of the recorded material. The title will usually be augmented by data relating to the length of the contents and its physical position on the video tape which will be completed automatically. The FAT is recorded on the tape at the end of each recording session. More particularly where a new FAT is written to the storage tape when a new signal or data is appended to the tape, each new FAT contains additional information related to the appended signals or data plus data corresponding to the previously recorded FAT. Thus each successive FAT is a

cumulative index. Prior to commencing a new recording session the last FAT is written into memory 4 preferably automatically under the control exercised by the CPU so that when the new FAT is created this information can be incorporated into the new FAT. It is proposed that when the VCR is being programmed for recording, the user is presented with recording options conveniently by way of a display on screen or an I/R hand set. The CPU controls the generation of an option menu using the video system to permit the user to enter contents information for the material to be recorded. The software in the CPU can automatically issue control commands to the I/R unit to control the VCR. Using the I/R unit, I/R signals are transmitted to the VCR to instigate rewind, fast forward, playback and record functions so that current tape position and current tape contents can be identified and the necessary information written into memory. During playback the data index is read from the tape by the VCR passed to the decoder so that a track of the current tape position is known. When a user wishes to locate a specific item on a previously recorded tape, the operations involved will be as follows . For ease of use, the present invention proposes that the tape is automatically stopped at the beginning of the last recorded FAT. Thus on inserting a tape, the CPU will perform a playback operation to read into memory the controls of the tape from the FAT and the current tape position from the data index. Information identifying the contents are conveniently displayed on screen. The CPU preferably provides a menu for selecting options such as playback or delete. Once a desired playback option has been selected the CPU directs the VCR to the current position on the tape as the time for fast rewind or fast forward will be calculated in relation to the current and desired tape position having regard to the

characterisation data of the VCR.

A similar process can be followed for record. The user menu can provide record options for example connection time for recording, material to be recorded e.g. record T.V. material, T.V. material with data, internet data etc. and will allow the user to input characters identifying the contents which will become part of the FAT for subsequent identification purposes. Thus it will be apparent from the above that the position of the tape can be initiated using the I/R controller and facilitates automatic positioning of the tape to a selected position.

From the contents of the FAT it is possible to determine whether sufficient unused tape is available for new storage of new signals or data. The programme software can be used as means of selecting which existing signals or data can be over written in order to provide sufficient storage for new signals or data.

Referring specifically to Figure 2, the leading end of a length of video tape is illustrated in a manner to show how conventional analogue video may be recorded on successive frames - see for example frames such as those referenced a/v - between these frames are the vertical blanking intervals (reference VBI) which can store data at the rate of the order of 640 Mbits/hr. In accordance with one aspect of the invention, some of the VBI are used as the location for the 'periodic' data indexes see DT1 and DT2. Two are shown in the example six frames apart. This spacing is only for illustration purposes and not to be taken as necessarily representative of the actual spacing. The data indexes include time code, frame number, total frames and session name in a preferred implementation of the invention. The session name may be the equivalent of a track reference assigned automatically by the recording software to

each particular recording session, or user input information identifying the recorded material by its contents.

An index is provided for each recording session and is recorded at the end of each session. These are the files indexes or a file allocation tables for which the reference FAT is used in the illustration. Two tables are shown - representing the contents of two recording sessions. It will be noted that these blocks of data occupy the a/v frame and the VBI and typically they are capable of accepting data at the rate of 4 to 20 Gbits/hour for a typical domestic video cassette. The successive file allocation tables are cumulative, i.e. each successive table contains the contents of all the previous tables and contain certain data segment indexes, physical position and video position data relating to each recording session.

In operation it is preferred that the tape control system will operate to locate the last FAT so that the contents of the tape may be displayed to the user for the purpose of selecting playback and recording options. A preferred mode of operation leaves the tape at the end of the last recording session. The index is displayed on screen and for playback the user selects the desired session. The tape controller uses the characterisation data for the tape storage mechanism (VCR) in conjunction the current tape position data to determine the time for which the tape rewind has to operate to end up at the desired position; whereupon the control device switches to playback so that the data index can be read to confirm that the correct position has been reached and if not the machine makes further adjustments and playback checks until the desired position has been reached. At this point, the recorder either commences playback if auto playback has been selected or awaits input of the

playback instruction.

A corresponding process can be used where a recording is to be made at a position on the tape other than at the end of the last recording. In the recording mode, data indexes are automatically added to the tape at the prescribed periodic intervals and at the end of the recording session the file allocation table is compiled and recorded on the tape. Titling may be recorded at this stage by the user, but more usually is input when programming in details of the recording session. Position information and programme duration in terms of time and total frame numbers is derived by calculation from information read into memory and then recorded in the file allocation table. The contents of any previous file allocation table for that tape are input from the storage memory to give the cumulative file allocation table.

CLAIMS

1. A video tape control system comprising means operable to control a tape storage device, said means including means for determining tape position based on data received from a tape reading means, which data has previously been encoded onto the tape.
2. A tape control system as claimed in claim 1 further comprising means for encoding the data to be recorded onto the tape at prescribed intervals.
3. A tape control system as claimed in claim 1 or 2 in which the data comprises one or more of time code, frame number, total frames and session name.
4. A tape control system as claimed in anyone of claims 1, 2 or 3 in which the data is recorded in selected Vertical Blanking Intervals.
5. A tape control system as claimed in which tape control is instigated using an infra-red control signal.
6. A tape control system as claimed in anyone of the preceding claims further comprising means for issuing infra-red command sequences to automatically reposition the tape to a selected desired position utilising characterisation data determined for the tape storage device.
7. A tape control system further comprising recording onto the tape an index of material recorded on the tape which provides readable information identifying the nature of the recorded material and its position on the tape.
8. A tape control system as claimed in claim 7 in which multiple file indexes are recorded on the tape, one after each recording session.

9. A tape control system as claimed in claim 8 in which the successive file indexes are cumulative.

10. A tape control system as claimed in anyone of the preceding claims comprising memory means external to the tape for holding the content of at least one file index.

11. A tape control system as claimed in anyone of the preceding claims in which the tape storage device is a video cassette recorder.

12. A video tape control system substantially as hereinbefore described with reference to the accompanying drawings.

13. A storage video tape recorded with data and/or file indexes substantially as hereinbefore described and illustrated in the accompanying drawings.